Interviewee: MO_04

Name: Anonymous

Role / Title: Research Scientist

Organisation: Met Office

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Interviewer: Paula Goodale

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Note: Some additional clarifications have been added to the transcription by the interviewee. These are indicated by the use of [brackets].

Q: So if you could start by-- if you could give me an outline of your role, where it fits into the scheme of things here, and kind of, I suppose how you got into that role as well, would be quite interesting. A little bit of a potted history, and a current focus.

A: Okay, so I've been working in my current role here at the Met Office for as long as I've been at the Met Office, which is almost four years. So my job's divided half and half between developing climate datasets and reporting what's been going on with the climate based on the data that's produced here and elsewhere, for either the public, or the government, or the World Meteorological Organisation. So that's kind of the half and half split between the two.

Q: Okay. And so, could you tell me something about, so in terms of the--, so lets look at the datasets first of all, tell me about what that work involves.

A: Okay, so my work's mostly on temperature data. So I work on long term records of temperature, when you say long term you're talking about from about the mid 19th century until present. Normally monthly averages. And the main datasets I work on for that are HadCRUT4 and CRUTEM4, at present so CRUTEM4 is just temperatures over the land. And we work with a team at CRU on that. And HadCRUT4 is a combination of the CRUTEM4 land temperature data and a dataset called HadSST3, which is sea surface temperatures. And that's the global product.

Q: Right, okay. So tell me where you get the data from those to go into those datasets.

A: Okay, so the data for CRUTEM comes from a range of different sources. Ultimately it will have to come from the country in which the observations were made. So for the older records these are quite often kind of consolidated repositories of information that have been built up generally by academic researchers over years and years. Or otherwise records from national meteorological agencies. For the most part the information we have available are monthly summaries, so summaries of average temperatures over the course of a month. Rather than

starting from say the individual observations made off the ground. So that's largely the older data.

A: For current data there are regular updates, we get information from transmissions from all these different countries, from the different meteorological agencies. So we're collecting that information, do a level of quality control on it to look for gross errors. And then that will eventually be incorporated into the land temperature dataset.

Q: Is it relatively easy to get hold of that data?

A: Yeah, it's all--,

Q: Is it kind of in there in the cloud or whatever?

A: Pretty much. It's completely freely available. We're most definitely not the only centre that collects that information. There's a couple of American Centres that do. There are centres in Germany and Japan that are responsible for checking the quality of the transmitted information. The German centre also specialises in precipitation data and the Japanese centre specialises in temperature data. So the messages are freely available and used by a lot of different centres. [section edited from published transcript at request of interviewee]

[At this point I should also mention WMO Resolution 40. This resolution outlines the requirements for free international exchange of meteorological information between countries that are members of the World Meteorological Organisation. Much of the data that goes into our products is derived from information exchanged under WMO Resolution 40. The resolution stipulates the minimum requirements for data exchange for various purposes and where members may and may not place restrictions on usage of the shared data. See the following link for details: http://www.wmo.int/pages/about/Resolution40_en.html - section added by interviewee]

Q: Yeah. And you take it from the Met Services?

A: Yeah, the Met Services will transmit the data on what's referred to as the Global Telecommunication System, or GTS.

Q: And you pick it up from there?

A: And we pick it up from there.

Q: Okay. Right. And is that done like, is it kind of real time or is it periodical?

A: For these messages they're monthly summaries. So they're compiled generally within the first week of the month for the previous kind of month.

Q: Yeah. So there's s cycle of work is there that kind of?

A: Yeah, yeah. There's a monthly cycle of work for that. There are other sources of data that don't go into those datasets, like the synoptic messages, which are reported every three or six hours. And that information would go into say the weather model here, for forecasting

purposes. So there are other messages that are used for different purposes, and more real time.

Q: Okay. So when the data comes in does it have to go through some kind of, you know, harmonisation? Is it always in the same format?

A: It's predominantly in the same format. The information is occasionally expressed in different formats, particularly by less developed countries that don't necessarily have the infrastructure in place to consistently produce the same records. So on a few rare occasions we'll have to have a look through the different formats and perhaps convert them, but generally that's only a small number of stations, almost every single report send over GTS.

Q: Okay, so all the data comes in-- what do you do with it when it gets here?

A: Okay, so the first thing to do will be to go through it and check for any formatting errors in the records, which is--,

Q: Is that by eye or is that by kind of a---?

A: It's largely a manual process, it's assisted by computer, so if there's something that the computer can't understand then there'll have to be a level of manual intervention to go in there, which will be often to just say that we can't interpret the information, and throw it away. Or if it's possible to--, if there's say a very simple error in there like just a slight formatting error, a lack of spaces where there should be spaces so it's possible to fix those. But otherwise for a lot of that data it would be well, a lot of the erroneous, the formatted data, it would have to be discarded if it's not--,

Q: So you would just delete it from the record?

A: Yeah, yeah. So this is, again largely countries where we'd have to type in these things by hand, in which case there may be the possibility for coding errors in that case. More developed countries tend to have automatic systems, so there's not an issue in that case.

Q: And so you've got all the data into and it's been checked for errors, does something else happen to it after? Does it get processed after that?

A: Okay, so that's step one is the formatting checks, to make sure we can basically get it into the computer. Step two is the actual value checks. So that will be looking for values that are particularly extreme and unexpected for a station in that location. Or otherwise values that are very much inconsistent with neighbouring stations. So again that's a process where it will be computer assisted. So there'll be automatic checks for that, but the ultimate decisions are always human.

Q: But is that kind of a judgement call? Do you have to go and have a conversation and say, you know, what's going on here?

A: A lot of the time it's quite clear if there's a major problem. So you may have like a power of ten problem, and you find out the station's reporting 70°C, which is quite clearly wrong.

Q: Yes, right.

A: And normally we can tell from the neighbourhood checks. On occasion we contact the met agency responsible for sending the message and ask what's wrong with it. But we also have the other sources of information from say these three hourly reports, so we can do a comparison of them, and do a kind of sanity check to make sure that the information makes sense.

Q: So at that point then is it ready to use or does it have to go through some more---?

A: To produce erm, okay, so one of the datasets based on that would be CRUTEM. So there's a final check, and that's just to make sure that there's not a value that's completely extreme, and had somehow slipped past. So there's an automatic check to make sure that those kinds of records wouldn't get through. But then at that point, generally it's er, the data's used to build the datasets and we will put a copy of the quality controlled information on our website for other institutions to use.

Q: So you post that basically as Met data and it's--, or just context. So you publish the dataset and you publish the stuff that's been--

A: Yeah, we publish both the, er, well we'll produce the dataset in whatever form that dataset takes, be it temperature maps or station data, and we also publish the quality controlled message summaries as well.

Q: And is that available then to anyone to use?

A: Yeah.

Q: Do you know what kind of people use it?

A: [For the meteorological observations that we compile] I know that the Climatic Research Unit use some of the pressure data for some of the climate indices. The data's picked up by the National Climatic Data Center in the US, who use it for quality controlled information combined with their data feeds to produce a publication called *Monthly Climatic Data of the World*, which is something that comes out generally about three or four months behind real time. And just gives monthly summaries of climates across the world. So they use it for that product.

Q: Is that targeted at certain people? Is it mainly used by science people?

A: Oh that's a publication that's mainly used by climate scientists. And then there are interested members of the public that do look at the information.

There are a few other products, there's some precipitation products produced by the German weather surface, who have taken our quality controlled rainfall information and incorporate that into their dataset.

[The climate data sets that we compile are used by a wide range of users. They used by scientists in many applications, including studying long term changes in the climate, comparisons with climate models and climate impact work. Derived products also contribute

to climate assessments that put current conditions into long term context to provide information for policy makers and the general public.]

Q: Okay. So are there any kind of, you know, governing process of it, so who decides what format the data should be in and that kind of thing?

A: Okay, the data formats [for transfer of meteorological station information] are stipulated by the World Meteorological Organisation.

A: Which erm-- if you're not aware that's a UN organisation. So they set up standards for how the messages should be transmitted, and the format of those messages, and also sort of the timing of when they should be submitted beyond the end of the month to make sure that the data comes in at a reasonable time to be usable.

Q: So it's quite prescriptive?

A: Er, yeah it's fairly prescriptive [for the transmission of meteorological observations between countries].

Q: Do you have any input into what those standards look like, or those formats? Or is it purely done over there in the kind of central--,

A: Okay, I'm not actually involved in that process myself. It's not really such a case of them being kind of put together over there, they're put together by a team of scientists and meteorologists working on these kind of subjects. The kind of people that you might find be invited to East Anglia or over from the US and the National Climate Data Center. So it's actually, these standards are actually put together by people who work with the information.

Q: Okay. So they're kind of the data specialists that are?

A: Yeah, yes.

Q: So obviously, you've got the various datasets that are produced here. Presumably there are different datasets that are produced by other organisations?

A: Yes.

Q: Is it a historical thing about who produces which dataset, or is there some kind of you know, areas of expertise that are? Do you know anything about that?

A: Okay. It's a good question how people actually came about producing these datasets. There are normally considered to be sort of three more long running datasets that have been produced for a long period of time. One of which would be CRUTEM, and also following on from that, HadCRUT. The NOAA, National Climatic Data Centre produce a dataset called GHCN, monthly, which again, is a dataset that's been produced for a few decades, with various updates over the time. There's a group that's part of NASA Goddard Institute for Space Studies, who produce their own dataset as well.

Q: Right. And how do they differ? Are there major differences or are they sort of--?

A: Interesting for the land data the actual input data for each of the US groups is really very similar. What they do with that data following in their analysis, er, analysers and quality control of the data's a bit different.

Q: Hmm. But you're all kind of targeting the data at the sort of same audience? Are they used by the same people or--,

A: Largely yeah.

Q: One person prefers your dataset or one person prefers the other one?

A: Academics tend to have their own favourites. We would argue that they should really use all of the different datasets to get an idea of sort of the uncertainty and spread of them. But people have their favourites. There are other datasets that are appearing as well, so there's a group at Berkley University that have just started producing one. There will be slight differences in the input data for all of these different datasets. But the majority of the data will be quite similar because it all has to be sourced from the same observations generally, the same locations.

Q: Yeah okay. Great. You said there was another side of your work that was more about, you know, the sort of analysis of the--, was it analysis of the data that you?

A: Yes.

Q: Yeah, can you tell me something about that?

A: So that side of the work's more about summarising the information of the datasets because say the datasets created on HADCRUT are really gridded maps of temperature information from which climate scientists can use for all kinds of different studies. So one of the jobs is to package up that information in ways where it's kind of more useable for scientists, and also more usable to say policy makers, or the general public. So in that case it's interpreting the information at some point to whether sort of the climate in a certain state, say for the sea surface temperatures what's the state of the tropical precipitation because that has quite an effect on the climate surrounding it. Also producing things like global average temperature time series, which may be used for various different purposes.

Q: What would you say are the differences between the kind of the things that you produce for those different audiences?

A: A lot of actually the differences are--,

Q: Is it just the way it's presented or is there?

A: Yeah, the way it's presented does make quite a difference.

Q: So what do climate scientists want?

A: Climate scientists, as far as I can tell, want to be able to get hold of the data in a format that requires sort of a minimal amount of effort in just converting files for a start. So we need to provide it in a standardised format. So that's perhaps a slightly different area.

Q: Yes. And then, so the policy makers and the public? They're probably looking for something that's not quite so raw?

A: Yeah, they'll want something which has got more of a--, well they aren't often interested in the raw data. So things like graphical output is quite important for them. And while say a climate scientist might want the actual numbers and a full representation of what the uncertainties in those numbers look like, and how they vary over the time. Say a policy maker or a member of the public would be more interested in sort of just kind of a summary statistics, and maybe just sort of 'plus and minus so much' form of error range. So the kind of level of detail and going down to things like the uncertainty information differs quite a bit between those different audiences.

Q: And do you get involved in the actual communication side of that or is it?

A: Yes, so I work on things like the updates for the Met Office website, or climate science side of things for monitoring. We produce monthly summaries of the state of the climate for the previous month. So I'm involved in that side.

Q: And is there a specific audience in mind for those or is it just general users of the website?

A: It's general users, so it's largely for the general public. There's more detailed information that we produce and things like there's an annual paper that goes in to the Royal Meteorological Society's Weather magazine, which gives a kind of more detailed summary of the climate of the previous year. So sort of the level of technical details for the different media.

Q: And do you get much dialogue generated on the basis of those reports?

A: Erm, the dialogue's variable, we do get people contacting us directly or contacting us through the Comms team. And they're mostly for scientific dialogue in this one, in which case it's more direct contact with people.

Q: What sort of things are they interested--, you know, what sort of things do they want to talk about?

A: There are always people who are interested in the kind of the state of the climate, and a few people will be very interested in say whether the previous month or year has been particularly hot or cold, and why. And also sort of why if say if there's a--, what the causes of the might be, which is again straying a little bit further outside of the area that I work in, as I generally just work on the observations themselves. But there's definitely general interest in this, members of the public and scientists do contact us about it.

Q: Do you get a feel for what people are doing with that data? Is it just a general interest or are they using it for you know--,

A: Well, it's used for all kinds of different things. So the global temperature time series say is quite important from a policy point of view, in terms of things like targets for global temperature rise compared to pre-industrial say. And so they'll want to know what has happened in the

past to go together with what we're also predicting is going to happen in the future. So there's the policy side of things for that, so we're providing information required.

Q: Is that the specific department that's in the government or is, is it international or just UK?

A: It's partly UK, partly international. So we will report up to say the Department of Energy and Climate Change to provide the information they require for whatever purposes. And we'll also contribute to things like reports by the Royal Meteorological Society, and to the Intergovernmental Panel on Climate Change assessments as well.

Q: Yeah. So were you involved in the AR5?

A: Yes.

Q: Yeah. I went to the conference last week, so it was er, there was a lot to learn. So does yours go into the Working Group One?

A: Yeah. Most of ours is Working Group One. Mostly from the point of view of providing data for it.

Q: Right, okay. So they use the data, but they also look at research that's output from that don't they, as well?

A: Yeah.

Q: So, okay, what would you say really motivates you to work in this area? What makes it interesting?

A: What makes it interesting? In a way that doesn't make me sound like a complete geek.

Q: No that's [laughs]. You'd be surprised at the responses we've had on that question.

A: [Laughs] I always find the data analysis side of it really, really interesting. And the kind of statistical methods that we use to go from say individual observations that place onto global temperature maps. [section deleted from published transcript at request of interviewee]

Q: You like working with data?

A: Yeah, yeah.

Q: Is it kind of to do with, you know, what aspect--, so is it to do with the kind of the completeness, quality of the data, or is it to do with the outputs of the data? What's the kind of the really interesting part?

A: So the thing I find probably most interesting in doing this is the analysis of not just kind of the best estimate of what's happened, but how reliable that information is. What we can and can't say and working it out. The maths that goes into producing the error bars.

Q: So knowing that you've got--,

A: But also the interpretation of sort of what we can say based on that. So actually, yeah the final thing where you get out this thing at the end where you can say well, we can say it's gone up,

the temperatures have risen and our uncertainty on that based on say observational errors or of methods used to construct the dataset.

Q: And is that a kind of a--, so is that something that you work out amongst a group of you? How do you kind of work out what the core message is? Is it, you know, you kind of work together as, you look at the outputs and say, you know, we need to figure out what the key message is?

A: Well erm, so from--,

Q: How does it come about?

A: From producing the actual datasets and putting those error estimates on it there are a fair few people here working on it in different areas. And we also work in kind of collaboration with other institutions, much like any academic organisation would. So we do talk to experts in other centres, to the National Physical Laboratory, we talk to metrologists there, and we talk to statisticians to discuss different methods. So there is a fairly sort of group thing, and there's a lot of communication going on in developing it.

Q: So fairly international as well?

A: Yes. And so actually if I say perhaps I should mention some of the data sources side of things, one element of my work at the moment is to liaise with a group called the International Surface Temperature Initiative, who are going about trying to produce a sort of large central repository of as much temperature observation data as they possibly can. And so for representatives from a couple of dozen countries.

Q: So that's an international kind of--,

A: It's an international organisation.

Q: Kind of NGO type thing, or are they just collaborative?

A: Er, not really an NGO, it's more a--, it's a collaborative sort of partnership of the willing really. So we--,

Q: Do they have a physical presence, or is it just a kind of a virtual union?

A: It's a collaboration, so there is no central location for it, it's--,

Q: No, there's not an office, it's just--,

A: So the temperature data from CRUTEM goes into there, as does some of the other temperature data from the Met Office. But will get similar information through from lots of different countries, and which are trying to pool them all into a single central location. In this kind of dataset which is in a standard file format has as much information as possible. And then there's collaborations going on there in terms of developing new techniques for analysing the data, and making that data publicly available too.

Q: So that's kind of creating a degree of excellence. Would that be the right word or?

A: Erm, I'm not sure that excellence is a core driver in the—they do attempt to go for excellence, but the main drive in it is openness and transparency, and making as much data available to as many groups as possible. Because there are uncertainties in processing this data, the techniques used, and how it produces slightly different estimates based on the assumptions used in the kind of processing methods. So the idea being to get as much information out there for groups to use so that we can get more eyes on the problem, and get more estimates, and get a better idea of what we do and don't know.

Q: So openness is an important aspect of the data being available and used.

A: Yeah, absolutely.

Q: Is there any of the data that you think, no actually we should hold on to that because it's, you know, it's something that is unique to us and we'd quite like to have exclusivity over it for a while?

A: That doesn't tend to be a theme that pops up among climate scientists.

Q: No I haven't seen it, it's a curious, you know---

A: Yeah. There is occasionally an issue in trying to share data in that an agency or group would think that perhaps we're holding onto something, which has got commercial value. There are I suppose always going to be occasions where the data is obtained by say a private company and they will want to retain that data for themselves, and not share it. But for the most part we try to encourage meteorological agencies to share their data, as we try to share data.

Q: Yeah. Are there certain drivers for that or is, you know, is it for the good of the science, or what are the---?

A: Well, it's for the good of science, and openness is always a good thing because there will always be people asking questions on what's actually going on and will want to dig down into the data and find out for themselves, and if that's not available they can't do that. Also if we want to know what's going on in climates we can't do that without global data sharing.

Q: So data sharing is fairly core to the community that you work in?

A: Yeah absolutely.

Q: Yeah. Okay. How would you--, I mean I don't know if you can answer this. How do you see kind of the Met Office at Hadley positioned internationally, in amongst its partners and collaborators? Are you a leader? Are you a, just a, you know, on a level playing field? Are you a follower?

A: We lead on some areas. I guess for areas for--,

Q: Hmm. So what sort of those areas would they be do you think?

A: Things like the sea surface temperature datasets we have a very able team here working on that, and they're definitely leading the way in that. And that follows through into the global temperature products as well.

Q: Do you have any competitors in that, you know, is it a competitive environment or is it?

A: Well, there's always a balance there because we both compete and collaborate with a wide range of different institutions. Ultimately we want our products to be better, and the competition probably drives us towards trying to make products. But also the collaboration's required for that as well.

Q: So it's good competition?

A: Yeah, yeah, it's healthy competition.

Q: Good. Okay. And so, obviously we've mentioned CRUTEM, and you worked together with CRU on certain things. So, I just thought that what I hadn't covered was in terms of particular datasets where, you know, they're doing the land and you're doing the sea stuff. Does that happen in parallel and then it comes together? Or does one bit happen first and the other bit get added on? How does---?

A: So it happens in parallel. The land side of the datasets the historic data's generally put together, well, it's consolidated at the University of East Anglia, and then they'll provide us with the information to produce the datasets as a whole, the sort of main temperature estimates, and the uncertainty information to go with that. But the kind of historical data is put together at CRU.

[The historical data is compiled by the team at UEA who, having compiled a database of temperature records for weather stations around the globe, make that data available to use here at the Met Office. We then use that information at the Met Office to produce the gridded temperature maps and time series, merge that data with the sea-surface temperature dataset to produce global temperature estimates and derive the uncertainty estimates in these.]

Q: Right. That's the kind of very historical data, or the kind of data--,

A: Even running up to a few years into the past. Then we handle the monthly updates.

Q: Right. So that happens here and then--,

A: Yeah. So that's how things work on the land side of things. For the sea surface temperature side of things, the dataset we use for HadCRUT is called HadSST3, and is generated here, in parallel. So once these two datasets are available we will then combine the information from each of them to produce HadCRUT.

Q: Right. Yeah, that's a little bit clearer, because I wasn't quite sure you know whether that was, you know, you had to do one part first or---

A: No. The two datasets are generated in parallel and then combined together into one.

Q: Okay. I'm more or less out of questions. Is there anything else that you think would be useful to know about the work that you do, or you know, the datasets that you work with that I haven't asked you?

A: [Pause]. Tell me what you might find most interesting in terms of the er--,

Q: So what we're really interested in is, so you know, the production of the data, the processing of it, and then the use. So those are the three kind of areas that we're going through.

A: Okay. So perhaps something else you'd be interested in is the general versioning and sort of code quality control, and this kind of thing. So at the moment I'm working on building a version update for CRUTEM and HadCRUT so we'll have a kind of a fixed version. With a fixed version for a period of time until we have a data set update. And all the code requires to produce that version of the datasets version controlled, which means that we can see the changes that have been made, we can roll it back to previous versions, and keep a permanent record of what that code base looks like.

Q: Okay. So is that something that happens on a very regular basis, or is it like a---?

A: For these datasets we try to work on an annual cycle. So what we tend to do is that we'll have a large update from the University of East Anglia say, of the temperature data for a previous year, and we try to roll in the code updates at the same time.

Q: Right. And then that gets all released together.

A: So the er, we'll update the code, fix it, and then use that to produce future versions of the dataset. Provide a summary of all of the updates, what's happened to the code for that website. Do comparisons, regionally and for differences between the two from the change to the data, and put that on the website.

Q: What sort of things would be altered in the code? How would it be changed?

A: For the most part, actually for these datasets there's been very little in the way of updates to the code for the actual processing methodology. More usually it's to do with just changes in the computer system here.

Q: Right, so you're not necessarily changing how you do the---?

A: No the methodology hasn't generally changed. Not since the original release of that data.

Q: Right, okay. Will there be a, you know, a version, you know, say a HadCRUT5? How often do these things come around that you have a major change in the dataset?

A: Well, HadCRUT4 was originally released in 2012 I believe--,

Q: Right, so that's quite new.

A: Which is when the first publication came out. The version before HadCRUT3 came out in 2006. So there's a few years between the two of those. And we continuously work on updates, and do the underlying science over a period of time.

Q: So what would, you know, if you went from 3 to 4, what would be the major change between 3 and 4? Is there something that means you need to make it, you know, a new version?

A: I wouldn't say there's something specific to pin it down on one thing to make a new version. In the change from 3 to 4 we had a large increase in the amount of temperature data going into the datasets. So we managed to increase the coverage of the globe from that. We had refinements to the way that we presented the uncertainty information to make it more useable by scientists trying to use the data. And we had, from the sea surface temperature side of things, some updates to understanding of the way that observations made by different platforms differ and how that affects the temperature measurements. So for the SSTs, so you have observations made by buoys drifting around in the ocean. You have observations made by ships, either in very old data from say throwing a bucket over the side of the ship, hauling it up, putting a thermometer into it, and then writing down what the temperature was, or otherwise coming in through water intake into an engine room. And you'll find that there'll be a bias between these observations. You tend to find that engine room intake measurements are kind of biased slightly warm than--,

Q: Yeah. You would expect that wouldn't you?

A: Yeah, they're kind of heated by the surroundings. So we have updates to the way that we handle these, and for kind of understanding those biases. So there were quite a few changes in that update.

Q: So what do you think, you know, what can be improved next? Are there any areas that you think could be, you know, refined?

A: Well, there's always room for improvement. One of the things we're looking at is the way that we handle sparsely observed regions of the world, which is something which is kind of, it's a known issue with the existing version of HadCRUT4 that there are some regions that we just don't have observations or perhaps regions where we've got observations kind of nearby, but at the moment say there's a gap in the dataset where there isn't a weather station. But we can use statistical techniques to infer what was going on in those regions based on sort of knowledge of how temperatures vary nearby, and try to reconstruct it. So that's something that we're currently looking at.

And then there's always the understanding on kind of non-climatic effects on these temperature records, things like different observing practices, changes in the instrumentation, urbanisation.

Q: So would you say that those are kind of the major challenges in getting your work to the, you know, to the level that you'd like to have it? Is the kind of observing environment---?

A: Yeah erm--,

Q: Or are there other things that are particularly causing challenges?

A: So these are things that I'm currently looking at at the moment, and still trying to improve the way that we're handling these. So---

Q: So what holds that back? Is that, you know, just availability of resources? Is there more to it than that?

A: Erm, there's continuous updates to the kind of methods available, and kind of progress in various different related fields and statistics. And we try to gradually as techniques improve try to incorporate them into the datasets. So it's more of a kind of gradual kind of research process as we gain more information and try to incorporate that into the datasets to improve them as we go.

[END OF INTERVIEW]